A New Species of *Holomitrium* (Musci: Dicranaceae) from South America, and a Key to *Holomitrium* in the Northern and Central Andes of South America

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ABSTRACT. *Holomitrium azuayensis* differs from all other species of *Holomitrium* known from South America, Central America, and the Caribbean by its completely entire leaf margins. *Holomitrium xolocotzianum* H. A. Crum from Mexico is a similar species that has entire leaf margins below, but the leaves are toothed at the apex. It is a much smaller plant with shorter leaves that have a cucullate apex. Also similar is *H. pulchellum* Mitten from Central America and northern South America. It has subentire or weakly crenulate to sometimes serrate leaf margins, but it has more slender and erect leaves than *H. azuayensis*. The alar region in *H. pulchellum* is only weakly differentiated, and often fugacious, which also distinguishes it from *H. azuayensis*. This new moss species is currently known from Ecuador.

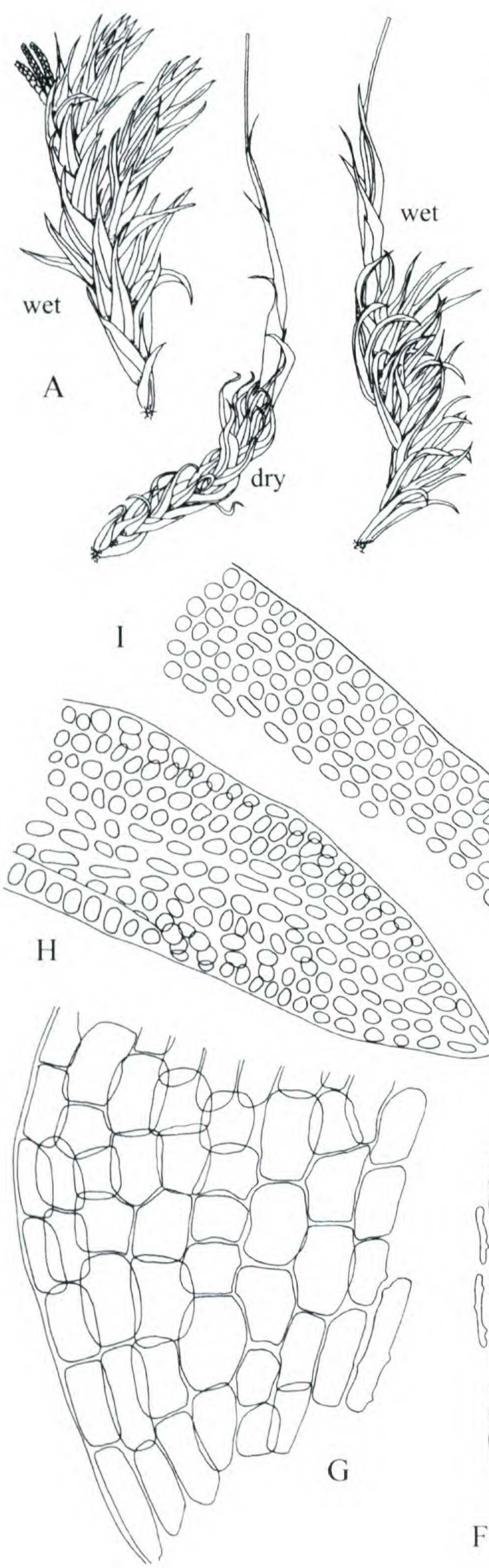
Key words: Dicranaceae, Ecuador, *Holomitrium*, Neotropics.

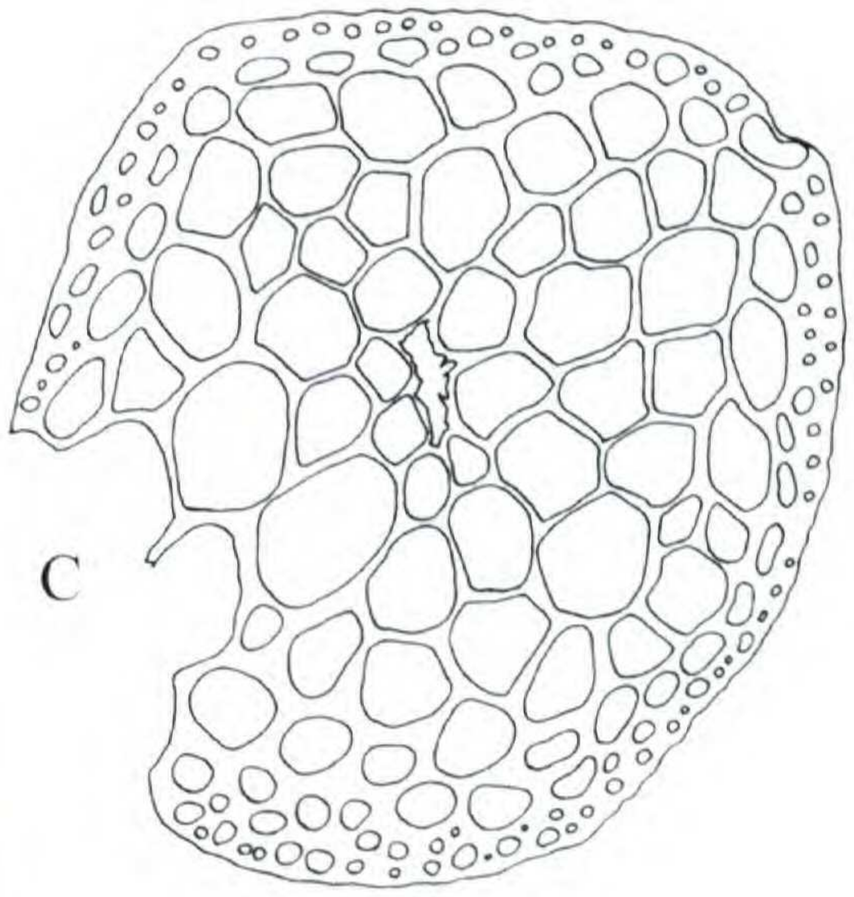
With around 30 species *Holomitrium* Bridel is one of the largest and most morphologically diverse of the epiphytic genera in the Dicranaceae. This moss genus is characterized by differentiated alar regions; strong, single costae with central guide cells; long, sheathing perichaetial leaves; cucullate calyptrae; long-rostrate opercula; erect, cylindrical capsules; weakly divided to entire peristome teeth that are fenestrate and papillose; and 2 to 3 rows of cell development above the capsule mouth constituting a persistent annulus. The genus has been recently treated from Mexico (Ireland, 1994), Central America (Allen, 1990, 1994), the Caribbean (Hegewald, 1978), and Colombia (Churchill & Linares, 1995). There are currently 15 species of *Holomitrium* in the Neotropics, 7 of which are known from the northern and central Andes. In this region of South America *Holomitrium* species are generally robust plants, predominantly epiphytic, and found at mid to high elevations. They tend to form cushions on tree trunks and branches in montane woodlands. During recent revisionary studies of the genus a new species was discovered from Ecuador. This new species, *H. azuayensis*, is distinct from all the other species in this region by its completely entire leaf margins. It also has peristome teeth that are sometimes joined at the tips, a feature that has not previously been recorded for *Holomitrium*.

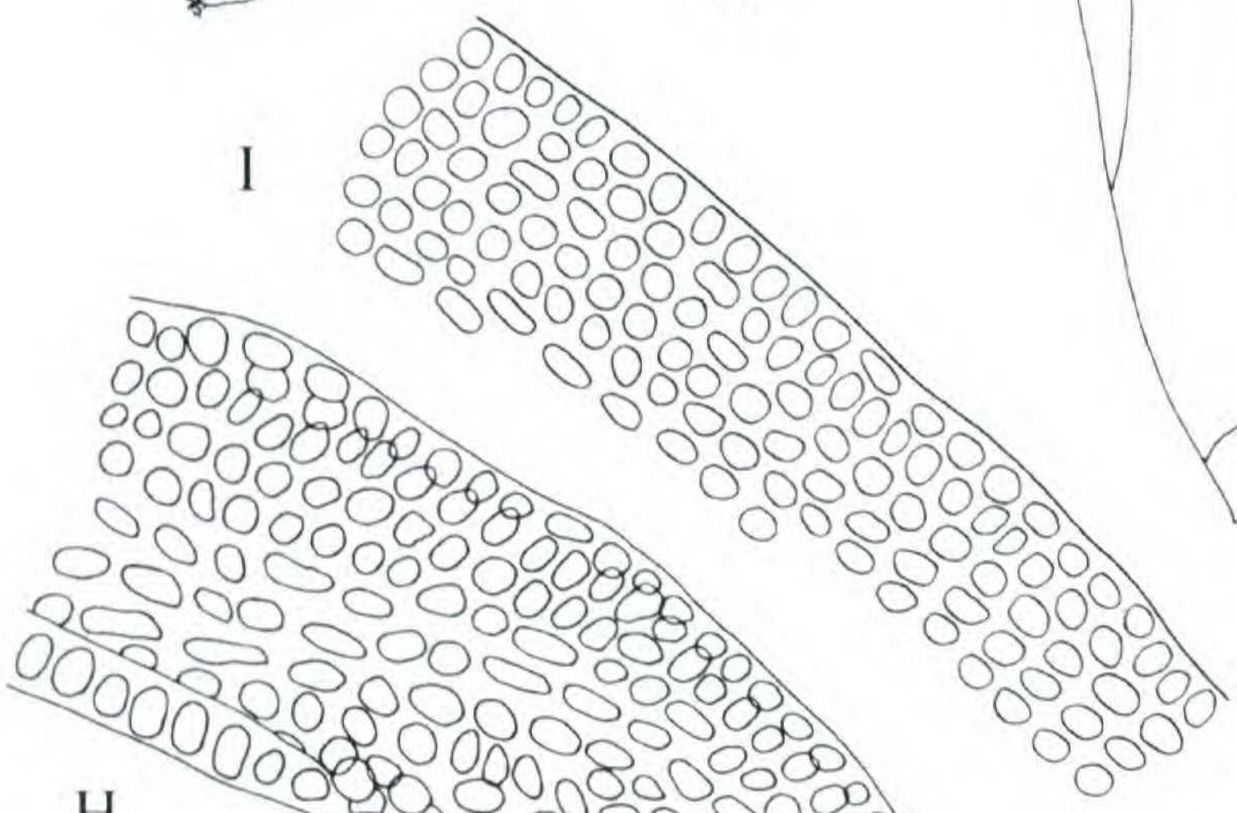
Holomitrium azuayensis M. J. Price, sp. nov. TYPE: Ecuador. Azuay: El Cajas National Recreation Park, 30 km W of Cuenca, in *Polylepis* woodlands on N facing slope of E-W valley to the N of Lake Toreadora, 3600–4000 m, 02°54′S, 79°17′W, 16 Sep. 1995, *M. J. Price 7* (holotype, MO; isotypes, BM, G, QCNE). Figure 1.

A *H. xolocotziano* statura grandi, foliis lanceolatis et grandioribus, marginibusque integris omnino differt.

Plants medium in size, light green-yellow above, brown-green to brown below, glossy, growing in tufts. Stems erect, 2.5–5.5 cm tall, radiculose throughout; branches irregularly bi-pinnate; tomentum dark red-orange, rhizoids hyaline at tips, smooth; stem cross section with scleroderm, outer cells small and thick-walled, inner cells large and thin-walled, central strand small; axillary hairs 2 to 4 per axil, 6 to 8 cells long, cells elongate, hyaline throughout. Leaves moderately spaced, erect at base, crisped above, secund or somewhat erect when dry, secund to erect-spreading when wet, lanceolate, 3–6 × 0.5–1.1 mm, tubulose throughout, unistratose; base short-decurrent; apex gradually acuminate; margins plane below, broadly incurved above, sometimes slightly undulate, entire throughout; costae single, slender, strong, subpercurrent, smooth at back, in cross section at mid-leaf with 4 central guide cells, dense dorsal and ventral stereid bands; median leaf cells below shoulder rectangular to oblate, incrassate, not to weakly porose, 15–53 × 7–10 μm, becoming longer toward costae; cells above shoulder rounded, quadrate, oblate or sometimes short-rectangular, incrassate, not porose,







(B) 1 mm 0.01 mm (C-I)

(A) 5 mm

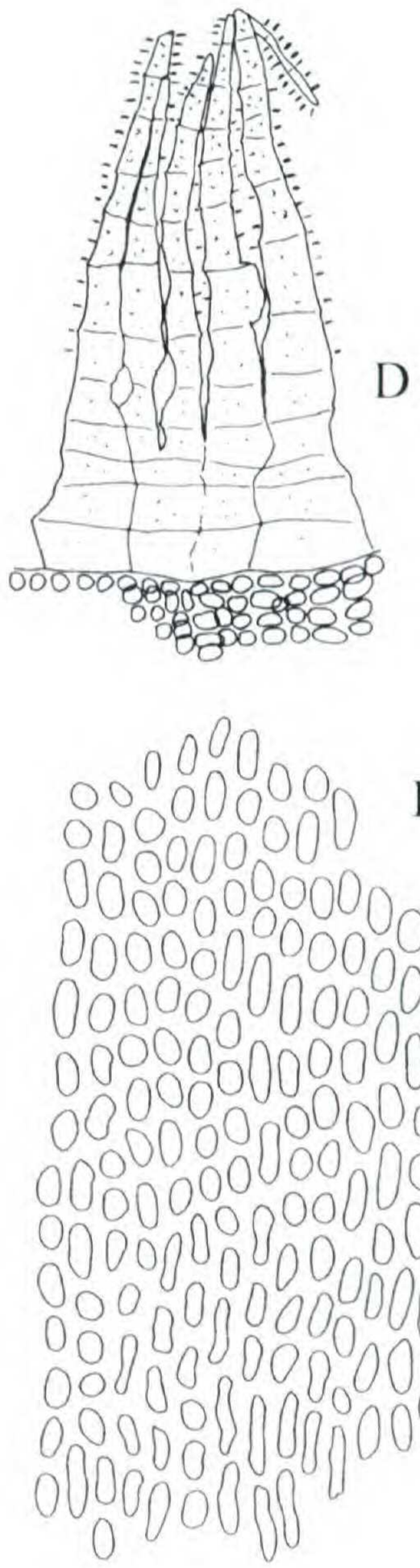


Figure 1. *Holomitrium azuayensis* M. J. Price. —A. Plants wet and dry. —B. Leaf. —C. Stem cross section. —D. Peristome teeth (external surface). —E. Cells at leaf shoulder. —F. Basal leaf cells. —G. Alar cells. —H. Cells at leaf apex. —I. Leaf margin and upper leaf cells. All from *Price 7* (MO).

12–27 × 7–13 μm, becoming smaller and quadrate toward apex; basal cells long-rectangular to rectangular, incrassate, porose, 32–113 × 13–20 μm; alar cells distinct, reddish orange, rectangular to subrectangular, 25–68 × 22–38 μm, persistent, incrassate, non-porose; marginal cells undifferentiated. Asexual reproduction by fragile flagellate branches, 5–12 mm long, clustered at stem apex or in branch axils, leaves to 1 mm long, costae subpercurrent. Pseudautoicous. Perigonia on dwarf males, growing on stem tomentum, in leaf axils or perichaetial bracts of female plants, plants 1–7 mm long, often with two antheridial bracts, leaves lanceolate, 1.5–1.7 mm long. Perichaetia terminal becoming lateral by subperichaetial branching, outer leaves erect below, erect to erect-spreading above, lanceolate to linear-lanceolate; inner perichaetial leaves long-sheathing, linear-lanceolate, 6–12 mm long; margins entire throughout, sometimes weakly crenulate at apex; costae subpercurrent; cells similar to vegetative leaves. Setae single, light yellow, erect, 20–25 mm long, twisted counterclockwise just below capsule, smooth. Capsules long-exserted, erect; urn long-cylindrical, symmetric, 2.0–3.5 mm long, to 1 mm diam., smooth; neck short; mouth slightly constricted; exothecial cells irregularly rectangular, thin-walled, yellow tinged with several rows of small red, incrassate cells at mouth. Stomata 6 to 10 per capsule, superficial, at base of capsule. Annuli persistent, as 2 to 3 rows of cells developed above the capsule mouth, cells homogeneous, quadrate to triangular. Opercula long-rostrate, 2.5 mm long. Peristome teeth 16, irregular, inserted at mouth, weakly divided or entire, teeth sometimes united at tips by inner peristomial layer deposition, fenestrate, irregularly thickened on outer surface, dark orange-red at base, fragile and hyaline above, narrowly triangular, 137–175 μm long without hyaline tips, when hyaline tips present 237–250 μm long, finely papillose below, papillose above. Calyptrae cucullate, smooth, 3–4 mm long, base entire. Spores spherical, 10–13 μm diam., lightly roughened.

Etymology. The specific epithet *azuayensis* was derived from the province Azuay, in Ecuador.

Distribution. Known from Ecuador.

Habitat. On trunks and branches of *Polylepis* in montane woodlands, growing as cushions mixed with *Chorisodontium* between 3600 and 4200 m.

Holomitrium azuayensis is a medium-sized plant, growing to 5.5 cm in height, with lanceolate leaves that are somewhat secund, moderately spaced, and crisped when dry. The leaf margins in this species are broadly incurved above, and completely entire throughout. Its alar cells are well developed and persistent, forming a distinct colored group at the basal angles of the leaf. The median cells near the leaf shoulders are rectangular to oblate, incrassate, and not to weakly porose. Its upper leaf cells are small, rounded, and quadrate to oblate or sometimes short-rectangular. These cells are incrassate, non-porose, becoming smaller and more regularly quadrate toward the leaf apex. The peristome morphology of this species is unusual within *Holomitrium*. A peristome tooth in *H. azuayensis* is split from one-third to one-half of its length, forming two hyaline filaments above. Some of these filaments are joined at the tips, to an adjacent tooth, by their ventral (inner) surfaces. So far, this feature has been observed in only a couple of other species of *Holomitrium* (*H. flexuosum* Mitten and *H. olfersianum* Hornschuch), and has not previously been documented for the genus. This peristome morphology is more typical for the genus *Dicnemon* Schwägrichen, where it is known in all species except one, namely *D. calycinum* (Hooker) Schwägrichen (Allen, 1987).

In overall aspect this new species most closely resembles the Mexican species *H. xolocotzianum*, described by Crum (1952). Both have secund, lanceolate leaves, similar upper leaf cell areolation, subpercurrent costae, and flagellate branches. However, *H. xolocotzianum* is a much smaller plant, growing only to 2.5 cm in height. It also has shorter, more sheathing leaves with a more pronounced shoulder than the new species. Leaf cells at the leaf shoulder in *H. xolocotzianum* are more uniform in shape, and are smaller than those in *H. azuayensis*. The cucullate leaf apices and apical teeth of *H. xolocotzianum* also distinguish this species from *H. azuayensis*. Capsule and peristome morphology of these two species differ. In *H. xolocotzianum* the persistent annulus consists of 6 to 8 rows of cells, compared with 2 to 3 rows of cells in *H. azuayensis*. The peristome teeth are densely papillose throughout and are not joined at their tips in *H. xolocotzianum*.

Holomitrium pulchellum and the closely related species *H. hawkinsii* B. H. Allen, from Central America (Allen, 1997), are similar to *H. azuayensis* in their leaf cell areolation, and in having nearly entire leaf margins. In *H. pulchellum* and *H. hawkinsii* leaf margins can vary from crenulate to serrulate or almost entire and toothed only at the very apex; they are never completely entire. *Holomitrium azuayensis* is distinguished from these two species by its lanceolate leaves with a completely entire leaf apex; well-developed, persistent alar regions; subpercurrent costae; and the presence of

flagellate branches. The Central American species *H. williamsii* E. B. Bartram shares with *H. azuayensis* the presence of flagellate branches, but it has serrate, irregularly bistratose leaf margins. All other species from the northern and central Andes are distinct from *H. azuayensis* by their serrulate to serrate or dentate leaf margins, while some others differ by their elongate cells throughout the lamina.

When *H. azuayensis* is found fertile the rather striking long, sheathing perichaetial leaves and crisped stem leaves when dry confirm that it belongs to *Holomitrium*. Two other genera in the Dicranaceae that are found in this region, *Eucamptodontopsis* Brotherus and *Schliephackea* Carl Müller, also have long and sheathing perichaetial leaves. *Schliephackea* is a pendent moss, with stems to 30 cm in length, and it has wide-spreading somewhat distant leaves that distinguish it immediately from *H. azuayensis*. *Eucamptodontopsis* is predominantly a Central American-Caribbean-Guyana Shield genus. It contains species with subentire, crenulate or serrate leaf margins, but the genus is characterized by leaves that are weakly spirally twisted or contorted when dry, and elongate, rectangular leaf cells throughout. The new species *H. azuayensis* can be distinguished from members of *Eucamptodontopsis* by its entire leaf margins, and by its small, rounded, and quadrate to oblate or sometimes short-rectangular upper leaf cells. When the new species is lacking perichaetia, the crisped leaves when dry, the differentiated and colored alar region, and differentiated lower and upper leaf cells (basal cells rectangular and upper leaf cells small and rounded to quadrate or oblate) can be used to identify it as belonging to *Holomitrium*.

Paratypes. ECUADOR. **Imbabura:** on old trail to Intag, 11,000 ft., 24 Nov. 1943, *W. C. Steere 9224* (MO, NY).

Key to the Species of *Holomitrium* in the Northern and Central Andean Region of South America

1a. Leaf margins entire throughout . . . . *H. azuayensis*
1b. Leaf margins subentire, crenulate, serrate, serrulate, or toothed above leaf shoulder 2
2a. Cell walls of upper leaf porose or sinuose 3
2b. Cell walls of upper leaf straight-walled . . . 4
3a. Cell walls strongly sinuose from just above alar region . . . . . *H. sinuosum*
3b. Cell walls straight to leaf shoulder, mostly weakly sinuose above . . . . . *H. flexuosum*
4a. Leaf margins and/or lamina irregularly bistratose 5
4b. Leaf unistratose throughout 6
5a. Leaves bistratose at margins and in patches across lamina . . . . . *H. crispulum*
5b. Leaves bistratose only at margins . . . *H. arboreum*
6a. Leaf margins subentire, crenulate or serrulate, serrate at apex . . . . . *H. pulchellum*
6b. Leaf margins serrate or dentate 7
7a. Leaves over 9 mm long . . . . . *H. moritzianum*
7b. Leaves under 9 mm long . . . . . *H. arboreum*

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